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13. ABSTRACT *(Maximum 200 words)*

This report summarizes our study of multiple scattering using supercomputers. Our emphasis has been on using fast algorithms to solve such a class of problem so that the memory requirements and computational complexity are reduced compared to conventional methods. We have developed several algorithms to achieve this end. These include nested equivalence principle algorithm (NEPAL), BCG-FFT algorithm, BCG-FFT T-matrix algorithm, the multilevel fast multipole algorithm (MLFMA), and the fast far field approximation algorithm (FAFFA). All these algoritthms account for multiple scattering effect within a volumetric scatterer or a surface scatterer with reduced computational complexity and memory requirements. Using BCG-FFT T-matrix algorithm, we have solve multiple scattering problem involving 10,000 particles on a SUN SPARC 10 workstation.

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MULTIPLE SCATTERING STUDY USING SUPERCOMPUTERS

FINAL REPORT

W.C. Chew

July 9, 1995

U. S. ARMY RESEARCH OFFICE

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DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
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A. STATEMENT OF THE PROBLEM STUDIED

We propose to study multiple scattering effect using supercomputers. This will be accompanied by development of new and novel algorithms to solve such problems. These algorithms will have reduced memory requirements and computational complexity so that larger problems could be solved on present day computers within a shorter turn around time.

B. SUMMARY OF THE MOST IMPORTANT RESULTS

Our finding is that for small particles compared to wavelengths, the traditional method of calculating the extinction coefficient using the QCA-CP is reasonable. However, to date, we have not been able to confirm this for larger particles.

In addition to the above, we have developed several novel fast algorithms for solving multiple scattering effects. These include the nested equivalence principle algorithm (NEPAL), BCG-FFT algorithm, the BCG-FFT T-matrix algorithms, the multilevel fast multipole algorithm, and the fast far field approximation algorithm. All these algorithms can account for multiple scattering effect within a volumetric scatterer or a surface scatterer with reduced computational complexity, and memory requirements.

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